OPERATIONAL UTILITY OF PERIMETER TRAPPING FOR REMOVING BROWN TREE SNAKES (BOIGA IRREGULARIS) FROM A DEFINED AREA

Richard M. Engeman[1], Steven Sayama[2] and Michael A. Linnell[2]

[1] *National Wildlife Research Center, 1716 Heath Parkway, Fort Collins, CO 80524-2719, USA,*
[2] *USDA/APHIS/ADC, 1060 Route 16, Suite 103-C, Barrigada Heights, GU 96921, USA*

ABSTRACT: The strategy of placing a trap line around the perimeter of a plot of land to remove brown tree snakes was evaluated using capture records from operational control efforts on two plots. This strategy appeared to be an effective, labor-efficient means for brown tree snake removal from an 8 ha plot. Interpretations from an 18 ha plot were not clearcut, because both trap effort and capture rates fluctuated substantially.

Key words: snake control, trap efficacy, trapping efficiency, trapping strategy

The brown tree snake, *Boiga irregularis*, was accidentally introduced to the island of Guam in the 1940s (Fritts, 1987, 1988). This exotic species has been responsible for the extirpation of several species of indigenous birds (Savidge, 1987), while threatening several others, as well as having become a significant agricultural (Fritts and McCoid, 1991), public health and safety (Fritts et al., 1990), and economic pest (McCoid, 1991). Guam is a focal point for air and sea cargo to many other parts of the Pacific and mainland United States, and there is considerable concern about the potential for introduction of the brown tree snake to other areas. Widespread control and containment activities at air and sea port facilities on Guam have been initiated to curtail the dispersal of the snakes. Much of the control effort has been directed at continual removal of brown tree snakes from these highest risk areas.

Brown tree snake control efforts by a variety of strategies have been actively carried out by the USDA/Animal Damage Control (ADC) Operational program since 1993. Snake removal from the blocks of land surrounding port areas is primarily accomplished through trapping. A particularly labor efficient trapping strategy has been to place a line of traps around the perimeter of an area of land from which brown tree snakes are to be removed. An alternative to perimeter trapping is cutting trails for trap lines through the jungle habitat where snakes are typically found. This approach significantly increases the labor for installation of traps and also increases the effort required to maintain the traps. In this paper, we use data contained in operational trapping records to evaluate the efficacy of perimeter trapping for removal of snakes from a block of land, and to gain insight on the size of land parcel for which this strategy might be effective.

Materials and Methods

A number of blocks of land adjacent to port areas on Guam have been targeted for brown tree snake control. Most blocks over a couple acres in size have been subjected to multiple trapping strategies (such as interior trap lines, boundary lines on one side of a plot, concentric rings of trap lines, perimeter trap lines), either simultaneously or separately. Complete capture records were available from an ongoing operational trapping program on two plots of land where trapping had been applied to only their perimeters. Both plots were adjacent to the south-east side of the Agana, Guam airport. Snakes were captured in modified minnow traps entered through flap doors. A live, caged mouse was used as an attractant. The habitat for the area in which both plots were located was forested almost entirely with tangentangen trees (Leucaena leucocephala), with the perimeters of plots

Time Period	# Traps
20–27 May 94	18
28 May–27 Jun 94	46
28 June–5 Jul 94	105
6–12 Jul 94	135
13 Jul–26 Oct 94	154
27 Oct–27 Nov 94	124
28 Nov 94–22 Mar 95	130
28 Mar–19 May 95	109
20 May–26 Jun 95	65
27 Jun–12 Jul 95	17

defined by roads, tracks, fence lines, grassy areas, or other generally manmade disruptions to the forest.

Plot A was approximately 18.2 ha in size and was of a general rectangular shape that could be contained within a border of approximately 1620 m. However, the forest edge of the plot presented an irregular boundary due to natural and manmade interruptions to the forest and, consequently, the actual forest perimeter available for trap placement was longer. The plot had been continually trapped on an operational basis since 20 May 1994. Trap placement

had been only on the plot perimeter, with the number of traps applied varying throughout the course of the control program (Table 1).

Plot B, at approximately 8.4 ha, was roughly half the size of plot A. It was rhomboid in shape and had been trapped continually since 27 October 1994. It, too, had only been trapped on the perimeter (approximately 1250 m in length), but the number of traps used was fixed at 50 throughout the trapping program. Both plots were evaluated on a catch per unit effort basis using information contained in operational logs on trapping effort and brown tree snake captures.
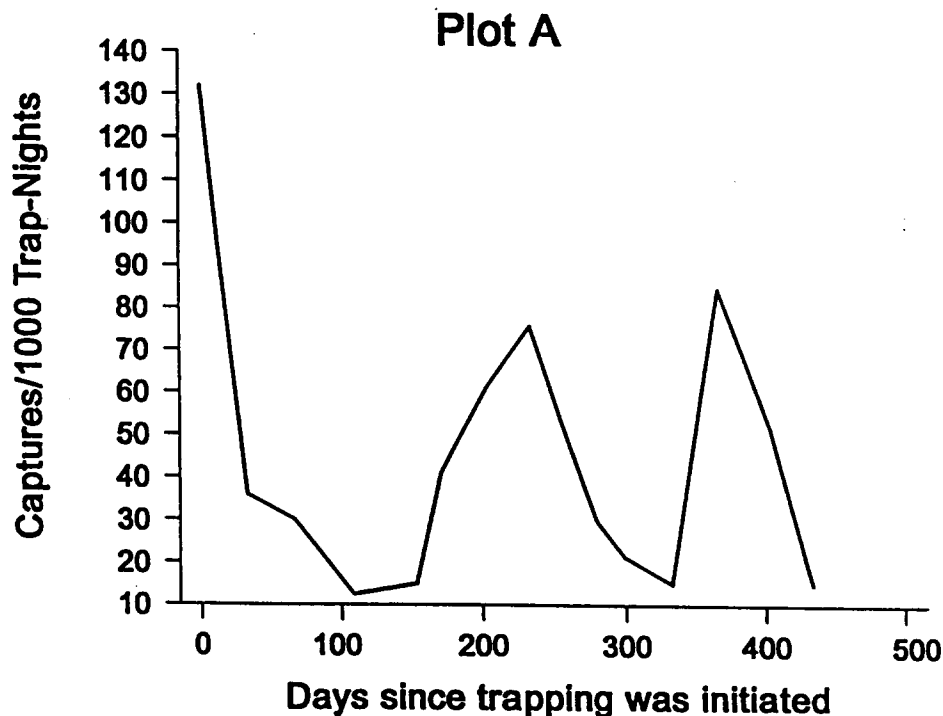
Results

Figures 1 and 2 present the capture results over time for plots A and B based on the number of captures per 1000 trap-nights. In 9 months, the catch rate on plot B (Fig. 2) decreased substantially from 43.4 to 3.6 snakes per 1000 trap-nights, providing an indication of a substantial reduction in the snake population on that plot. After 3 months of trapping, catch rates had stabilized at relatively low levels, perhaps indicating an equilibrium between removal and reinvasion rates.

The results for plot A (Fig. 1) contrast

Fig. 1. Brown tree snakes captures per 1000 trap-nights on plot A according to the number of days since trapping was initiated.

Plot B

Captures/1000 Trap-Nights (y-axis)
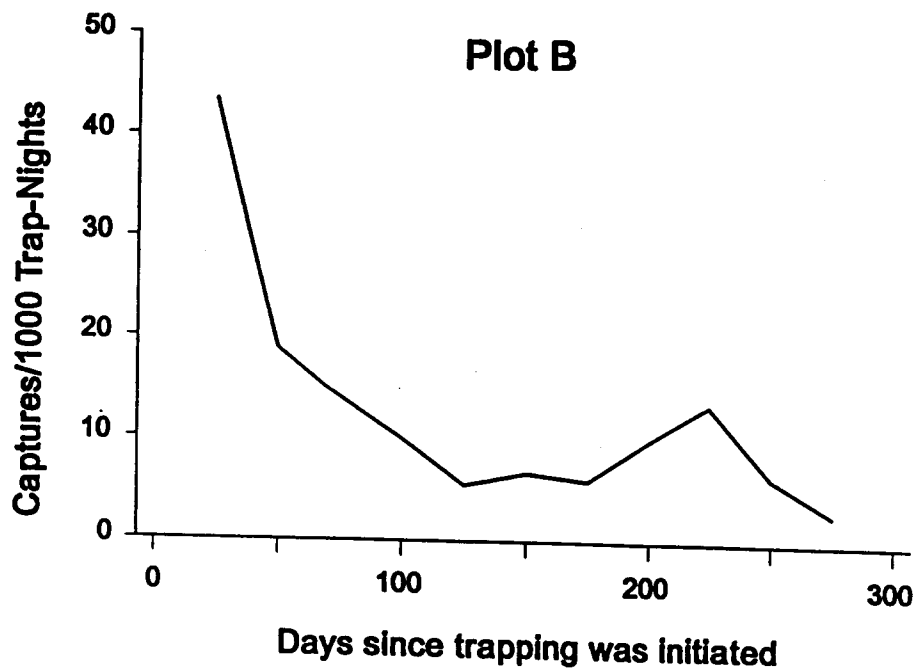
Days since trapping was initiated (x-axis)

Fig. 2. Brown tree snake captures per 1000 trap-night on plot B according to the number of days since trapping was initiated.

somewhat with those from plot B. Although the initial capture rate of 131.8 captures/1000 trap-nights exhibited for plot A was never subsequently approached, a sustained reduction in capture rates also was not achieved (Fig. 1). Despite continued trapping, succeeding peaks of 75.4 (Dec 94) and 82.1 (May 95) captures/1000 trap-nights occurred for plot A. Attempts to correlate changes in trap intensity and weather to the capture rates (using time lags from 0 to 3 months) produced no explanatory relationships. Thus, the proportional population reductions on plot A do not appear to be as substantial nor as effectively maintained as for plot B.

Discussion

Perimeter trapping is potentially a labor saving strategy to effectively reduce the brown tree snake population on a plot of land, as compared to the labor intensive process of cutting trails through jungle vegetation to create interior trap lines. Inspection and maintenance of traps on the interior is more difficult than on the perimeter where vehicle access is possible. Brown tree snakes have been shown to be highly mobile snakes over relatively large distances (Santana-Bendix et al., n.d.; Wiles, 1986, 1987, 1988). This makes it likely that, for moderately sized blocks of

land, a snake would regularly intersect the edge of the block in the course of its movements and, thus, be vulnerable to perimeter trapping. However, one would logically expect an upper limit on the size of plot or length of minimal dimension for which perimeter trapping would be efficient and effective.

The results presented here provide some insight to this question. The rate of removal through perimeter trapping on plot B was apparently sufficient to exceed recruitment to the population by re-invasion and reproduction. The length of the minimal dimension for plot B was approximately 210 m, with an area approximately 8.4 ha. While perimeter trapping on a plot of this area and minimal dimension appears to be a successful and efficient means for removing brown tree snakes, the upper size limits for successfully removing brown tree snakes from a plot by perimeter trapping possibly lie between the dimensions of plots A and B, especially if it is assumed that the snakes captured in these plots were mostly residents of the plot when trapping was initiated. However, there were fluctuations in the number of traps applied to plot A, resulting in the average spacing between traps varying considerably through time. Although we were not able to identify a relationship between trap intensity (or

21

weather) and subsequent capture rate, this could have a nonlinear effect on the catch rate, as well as allowing greater potential for re-invasion rates to vary.

We can speculate as to why perimeter trapping appears to be an effective strategy in addition to being labor-efficient. It is possible that when a brown tree snake moving through a forested area reaches an edge, it will be more likely to remain in the trees and follow the forest edge for a distance, rather than to immediately descend and cross a more open space. Thus, the success of perimeter trapping undoubtedly relates to the spacing of the traps on the perimeter. Although it is well known that brown tree snakes will cross open areas, a tendency for them to remain on the edge of a forested area would make them more susceptible to perimeter trapping than interior trapping, as there would be a relatively greater proportion of time spent on the edge (presuming that movements on the interior are somewhat random). In addition, perimeter trapping presents a hazard for brown tree snakes re-invasion from outside the plot.

REFERENCES

Fritts, T. H. (1987) Movements of snakes via cargo in the Pacific Region. 'Elepaio, 47: 17–18.

Fritts, T. H. (1988) The brown tree snake, Boiga irregularis, a threat to Pacific Islands. Biological Report 88(31), U. S. Department of Interior, Fish and Wildlife Service, Washington, DC 20240. 36 pp.

Fritts, T. H., M. J. McCoid and R. L. Haddock. (1990) Risks to infants on Guam from bites of the brown tree snake (Boiga irregularis). Amer. J. Trop. Med. Hyg., 42: 607–611.

Fritts, T. H. and M. J. McCoid. (1991) Predation by the brown tree snake (Boiga *irregularis*) on poultry and other domesticated animals on Guam. Snake, 23: 75–80.

McCoid M. J. (1991) Brown tree snake (Boiga irregularis) on Guam: a worst case scenario of an introduced predator. Micronesia Suppl. 3: 63–69.

Santana-Bendix, M. A., Maughan, O. E., Meretsky, V. and Schwalbe, C. B. (n.d.) Unpubl. rep. on file with Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ. 37 pp.

Savidge, J. A. (1987) Extinction of an island forest avifauna by an introduced snake. Ecology, 68: 660–668.

Wiles, G.J. (1986) Preliminary results of a radio-tracking study of brown tree snakes on Guam. *In*: R.D. Anderson, P. J. Conry and M. E. Molina (eds.), Annual Report. Fiscal Year 85. Guam Aquatic and Wildlife Resources Division, pp. 127–135. Dept. of Ag, Mangilao, Guam.

Wiles, G. J. (1987) Movements, home range and activity patterns of brown tree snakes. *In*: R. D. Anderson and P. J. Conry (eds.), Annual Report. Fiscal Year 86. Guam Aquatic and Wildlife Resources Division, pp. 138–140. Dept. of Ag, Mangilao, Guam.

Wiles, G. J. (1988) Movements, home range and activity patterns of brown tree snakes. *In*: G. R. Grimm and L. L. Mariano (eds.), Annual Report. Fiscal Year 87. Guam Aquatic and Wildlife Resources Division, pp. 139–142. Dept. of Ag, Mangilao, Guam.

要　約

特定の地域からミナミオオガシラを排除するための
周辺トラップの実用性

Richard M. Engeman[1], Steven Sayama[2]
and Michael A. Linnell[2]

ミナミオオガシラを排除すべき地点の周囲に線状にトラップを並べる方法について，実際に駆除を行った2地点の捕獲記録を使って評価した．この戦略は8 ha の地点のヘビの除去には効果的だったが，18 ha の地点では捕獲データの変動が大きく，効果のほどははっきりしなかった．

[1] National Wildlife Research Center, Colorado
[2] USDA/APHIS/ADC, Guam